FIMSUL

Report on Bivalve Farming

Project Title

Fisheries Management and Sustainable Livelihood-Component II- Bivalve Farming

Report prepared by

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The success of any project is highly dependent on the whole-hearted cooperation of the stakeholders. In this regard, we are very fortunate to get the whole-hearted support and cooperation of the fishers and village leaders of the study area. We express our sincere gratitude to the village and community leaders of Senjiamman Nagar village in Thiruvallur District, Cuddalore Chinnakuppam and Kottaikadu villages in Kancheepuram District for their unstinted support in farming of mussels and oysters.

We are very much grateful to the beneficiaries in these villages who participated in the bivalve farming and provided their continued support throughout the farming period overcoming all the obstacles and making the farming, a successful activity.

Executive Summary

Bivalves are high quality proteinaceous sea food which have several health benefits. They are natural bio filters that purify the ecosystem besides providing nutritional security to the fish consuming population. However, in spite of the benefits, the consumption of these bivalves has been confined to some coastal areas along India. Therefore, there is a continious effort from Central Marine Fisheries Research Institute (CMFRI) to create awareness among the people on bivalve consumption. The CMFRI has also developed technologies for scientific bivalve farming and CMFRI'S collateral effort with State fisheries department, the technologies have been refined and upgraded through many location specific technology demonstrations to make it a profitable aquaculture venture in coastal States in India. The farming practice is simple, ecofriendly and no input cost for feed.

The coastal stretch of Tamil Nadu is endowed with large number of east flowing rivers forming productive estuaries offering natural beds of oysters and mussels and also provides sheltered areas for bivalve farming. Though bivalve farming has started long back in Tamil Nadu, regional challenges such as low local market demand, limited access to the market in other States and low market price impeded commercialisation of the technology. However, in the current scenario there is a marginal increase in market demand for bivalves in big hotels and resorts and also in the local market. Therefore, under livelihood programme Tamil Nadu State fisheries Department with technical support from Madras Research Centre of ICAR-CMFRI has again attempted to popularise the bivalve farming technology by involving local fishermen in three fishing villages i.e. Senjiamman Nagar in Tiruvallur District and Cuddalore Chinnakuppam and Kottaikadu village in Kancheepuram District which will facilitate additional income through farming and enhance their socio-economic status.

Beneficiaries were selected from each village to participate in practical dissemination. Local people of selected village were given priority which in turns help in easy monitoring of the culture site and farmed animals. They are completely involved in all stages of bivalve farming like preparing of cultch, fabrication of rens, deployment of rens for culture, monitoring of growth, cleaning and monitoring of rens for better management.

The suspended “Rack and Ren” farming method, advocated by CMFRI for the shallow areas in protected bays, lagoons and estuaries was adopted for bivalve farming in all the fishing villages. Racks were constructed as a square platform using casuarinas and bamboo poles and these were fixed at 50 cm above mean high tide level. Mussel seeds collected from natural beds were reattached to polypropylene/coir ropes and were suspended from fixed rack for grow out while oyster spat are collected from estuaries by placing suitable collectors called cultch in the water column at appropriate period. During spawning season, the spat collectors are suspended from racks. After seeding, bivalves were allowed to grow for 6 to 7 months.

The oysters and green mussels were harvested when the condition is high i.e with good meat condition. Partial harvest was carried out to demonstrate the harvest as well as the post harvest protocol to the beneficiaries on 28 to 29 November, 2018 in Senjiamman Nagar while in Kottaikadu it was done on 25th to 26th April, 2019. Partial harvest was done manually one string after one by the beneficiaries. A temporary depuration facility was set up to demonstrate the depuration process to the beneficiaries to remove the bacterial contamination which will enhance the quality of the meat and also will increase the market price. The money collected by selling the meat was handed over to the beneficiaries. The economics of bivalve farming (oysters and mussels) were worked out based on our field study. It was found to be a profitable in both the villages and the profit percentage was 20.6% and 72.3% in Senjiamman Nagar and Kottaikadu village respectively.

The successful harvest of cultured edible oyster, *Crassostrea madrasensis* and green mussel, *Perna viridis* under technical support of CMFRI widened the scope for scientific bivalve farming in Tamil Nadu. The beneficiaries of both the villages are willing to continue bivalve farming with the support from State fisheries Department.

1. INTRODUCTION

Aquaculture is the fastest growing food production sector in the world with an average of growth rate 6.9% per annum and now accounts for nearly half of the global fish production. Given the projected population growth over the next two decades, it is estimated that at least an additional 40 million tonnes of aquatic food will be required by 2030 to maintain the current per capita consumption. With capture fishery production relatively static since the late 1980s, aquaculture has been responsible for the impressive growth in the supply of fish for human consumption. Whereas aquaculture provided only 7 percent of fish for human consumption in 1974, this share had increased to 26 percent in 1994 and 39 percent in 2004. Species such as shrimps, salmon, bivalves, tilapia, carp and catfish have been instrumental in driving global demand and consumption, thanks to the shift from being primarily wild-caught to aquaculture-produced, with a decrease in their prices and a strong increase in their commercialization (FAO, 2016).

Among the Asian countries, India ranks second in aquaculture and third in capture fisheries production and is one of the leading nations in marine products export. CMFRI has played a major role in commercialising of culture of many species such as mussels, edible oysters, pearl oysters, sea cucumbers and seaweeds, which has now led to a fledging small-scale industry.

1.1. Socio-economic and nutritional importance of bivalve farming.

Most of the coastal nations are faced with the problem of uplifting the socio-economic conditions of small-scale coastal fishermen. This problem has become more serious as a result of dwindling catches from coastal fishery resources. The rapid population growth in coastal communities has all the more exerted increasing pressure on the productivity of these resources as fishing effort from the artisanal fishing sector has been increasing. A strategy which some developing countries could undertake to find alternative economic activities for small-scale fisher-men would be farming of bivalves as oysters and mussels. Bivalves are filter feeders, filtering copious quantity of phytoplankton in water and converting it efficiently into

high quality proteinaceous seafood. The farming practice is simple and capital intensive with no input cost for feed. Further, in comparison with the other farming practices, bivalve are produced at lower trophic levels, the reason being that they naturally feed on phytoplankton. Scientific reports on the human health benefits from bivalve consumption, and their eco-friendly image among species coming from aquaculture, have attracted new consumers to this species group. All major consuming countries reported high requests for bivalve products. Production is increasing, but it is generally not enough to completely meet the world demand, leading to growing prices in all major markets. Europe produced 632 000 tonnes of bivalves in 2014, and its major producers were Spain (223 000 tonnes), France (155 000 tonnes) and Italy (111 000 tonnes). Bivalve culture in China in 2014 was about 12 million tonnes, 5 times that produced by the rest of the world. Other major Asian bivalve producers include Japan (377 000 tonnes), the Republic of Korea (347 000 tonnes) and Thailand (210 000 tonnes).

Beyond the socio-economic impacts of shellfish, the shared biogeochemical functions of nutrient remediation, water clarification, bio deposition, and habitat creation make all suspension-feeding bivalves a valued provider of ecological services to the shallow-water ecosystems. A single adult oyster can purge 60 gallons of water a day. Indeed, shellfish are one of the best options for ecologically sustainable aquaculture and have the potential to significantly contribute towards the growing demand for seafood and it helps in reducing the Nation's seafood deficit. Shellfish aquaculture requires no feed additives, as bivalves take the nutrients, they need directly from the water column, and holds great potential for relieving pressure on wild seafood stocks and land-based protein sources. In fact, "the Monterey Bay Aquarium's respected Seafood Watch program rates both farmed mussels and oysters as a "best choice."

1.2. Bivalve Farming technology in India

Traditionally, in India, bivalves have always been considered as subsistence food of the poor, apart from of high consumption like the Malabar and Goa coasts. But, taking into account the status of bivalves in international aquaculture production (a third of the total by weight) and trade, focus was placed on developing technologies for its farming and seed production. Coastal aquaculture research for developing bivalve farming techniques in India was initiated in the early 1970s by Central Marine Fisheries Research Institute (CMFRI). By the end of the decade, technologies for pearl, mussel, edible oyster and clam culture were developed. The culture of edible oysters was pioneered by James Hornell in Pulicat lake. After a gap of seven decades, farming of edible oysters was taken up at Tuticorin Research Centre of Central Marine

Fisheries Research Institute (Nayar and Mahadevan,1983). Initially, rack and tray method for rearing was followed with lime - coated semi cylindrical terra cotta roof tiles used as cultch material for spat settlement. Later, rack and string method was used wherein the oyster shells were the cultch material, which reduced the cost of material and labour. Rope culture of mussels in rafts was first tried in the open sea at Vizhinjam and Calicut centres of CMFRI in the 1970s (Appukuttan et al., 2000). Later, success in rope culture system by rack culture in the backwaters helped in popularising mussel farming in Kerala and later in Karnataka where the wild seeds of mussels are available. CMFRI has played major role in developing as well as popularising bivalve farming in India. Though bivalve farming proved to be technologically and economically viable, it was not widely adopted by the farmers, primarily due to lack of awareness, social inhibitions and finance. Later it achieved commercial status after which the total mussel and oyster production due to concentrated effort of CMFRI from the nineties; the combined production has crossed 20,000 tonnes making India one of the top-ten countries in Asia in bivalve mariculture production. However, several issues hinder its development on a commercial scale.

There are several methods for bivalve farming adopted in India for oyster and mussel . These are

Rack method : This method is especially suited for estuaries and shallow seas. Bamboo or Casuarina poles are driven into the bottom, spaced 1-2 m apart. These stakes are connected horizontally with poles. The horizontal poles should be above the level of water high tide. Seeded rope can be suspended into the water for farming from these poles.

Long-line method : This method is considered ideal for unprotected open sea condition. Synthetic rope of 16-20 mm diameter is used for the long-line (mainline). The main line is supported with 220 litre barrels tied to it, spaced at 5 m. The long-line and barrels are anchored in position at either end using concrete blocks and nylon ropes. Seeded ropes are suspended from the long-line.

Raft method : Ideal for open sea conditions which are not rough. Square or rectangular rafts are made with sturdy bamboo or casuarina poles. Buoyancy for the raft is given by tying 5 barrels of 200 litre capacity (metal oil barrel painted with anticorrosive paint or synthetic barrel). Ideal size of the raft is 5 x 5 m. The rafts are to be positioned at suitable site in the sea using anchors (grapnel, granite, concrete).

1.3. Transfer of technology in Tamil Nadu

Tamil Nadu is endowed with extensive estuaries and protected waters, which are suitable for both mussel and oyster farming. Initially, bivalve farming started in 1972 which was for pearl culture at Tuticorin Research Centre of CMFRI along the southeast coast. Also, mussel farming and oyster farming were attempted in Tuticorin and Chennai (Madras) during 1977. Although the farmers were educated about the importance and economic importance of bivalve mariculture, low market demand, low farm-gate value and limited access to the markets impeded commercialisation of the technology. However, in the current scenario there is a marginal increase in market demand for bivalves in big hotels and resorts and also in the local market. Also, the technology of bivalve farming is simple, economically viable and eco-friendly.

Realising the importance of bivalve farming, under livelihood programme Tamil Nadu State Fisheries Department requested for technical support from Madras Research centre of ICAR-CMFRI to popularise the bivalve farming technology by involving local fishers. Therefore, Madras Research centre of CMFRI came up with a project proposal to enhance the livelihood of coastal fisherman through bivalve farming. It was decided that three suitable sites would be selected and beneficiaries identified to transfer the technology of bivalve farming through participatory demonstration.

The main objective of the FIMSUL II –component II-Bivalve farming were

a) To study the demand and market potential of edible oysters and green mussels in local and outside markets.

b) To identify suitable sites (three sites) for farming and spat collection

c) To identify suitable beneficiaries for carrying out farming demonstrations in a systematic manner.

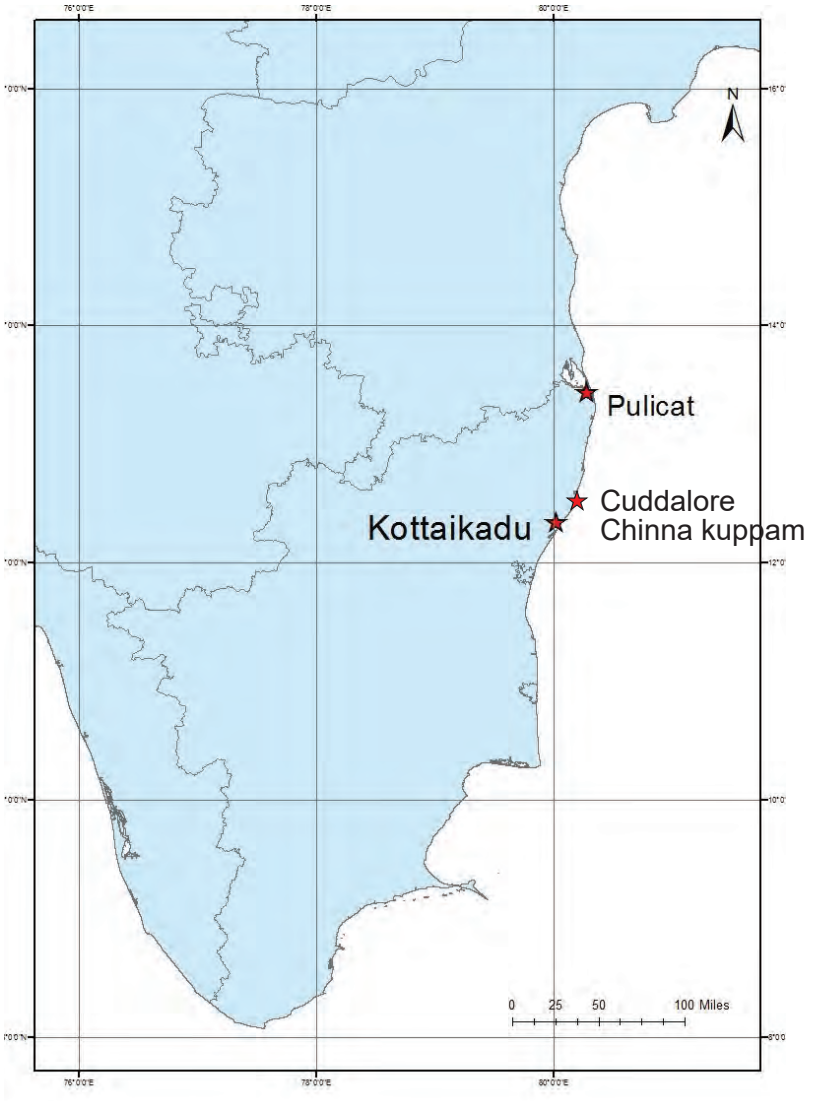
1.4. Identification of bivalve farming sites along coastal Tamil Nadu

The coastal stretch of Tamil Nadu is endowed with large number of east flowing rivers forming productive estuaries. The coastline stretching across the districts of Thiruvallur and Kancheepuram are marked by the presence of high narrow creeks offering sheltered areas for aquaculture activities. Considering the potential for bivalve farming in Tamil Nadu, surveys for selecting suitable sites for coastal farming were conducted by Madras Research Centre of CMFRI from 1st January to 1st February, 2018 covering 2 districts.

Criteria for site selection bivalve farming were:

- **Salinity**: is one of the important criteria for site selection. Marine mussels prefer salinity of 27-35 ppt while oysters of the genus *Crassostrea* are highly euryhaline tolerating low salinity ranges.
- Water salinity between 22-35 ppt was considered as suitable for bivalve farming.
- **Depth**: Water depth ranging from 2 to 6 m during low tide
- **Temperature**: Water temperature between 21-33°C
- **Productivity**: Water bodies with good phytoplankton production are essential for bivalve farming.
- **Water current**: Sheltered areas with moderate water
- Water body free of domestic sewage and other industrial effluent is suitable for farming.

Sites (both in the sea and backwaters) conducive for mussel and oyster farming in Tamil Nadu were identified through hydrographic surveys in the major estuarine, backwater and protected sea areas of the state. For the three selected farming site viz., Cuddalore Chinna Kuppam (in Kancheepuram district), Kottaikaddu (in Kanchipuram district), and Senjiamman Nagar (Thiruvallur district), monitoring for water quality, microbes and pollutants was being done. It indicated that bivalve farming done in these areas are safe for human consumption. Strict monitoring of the microbial load, biotoxins (algal blooms) and heavy metal pollution was also done to ensure food safety standards.



1.5. Selection of beneficiaries

Beneficiaries were selected from each village to participate in practical dissemination. Local people of selected village were given priority which in turns help in easy monitoring of the culture site and farmed bivalves. Most of the beneficiaries are engaged in bivalve collection to support their livelihood. They were completely involved in all stages of bivalve farming like preparing of cultch, fabrication of rens, deployment of rens for culture, monitoring of growth, cleaning and monitoring of rens for better management.

1.6. Bivalve Farming Method

Seed collection

Oyster spat

Oyster spat are collected from estuaries by placing suitable collectors called 'cultch' in the water column at appropriate period. During spawning season, the spat collectors are suspended from racks.

Preparation of cultch

Cultch is the term used for spat / seed collector. For suspended method of oyster culture, cultch made of oyster shells has been found to be ideal. Empty oyster shells are cleaned manually to remove the foulers and then washed to remove silt. A small hole is made on the shell and these are strung on 3 mm dia nylon rope with a spacing of 15 to 20 cm between each shell (5 shells per meter rope). Such strings are called ren. The spaced rens can be used also for grow out system. For seed collection purposes, the shells are strung continuously without spacers (10 to 15 shells per meter) depending on depth, and after the attachment of seed they shells can be removed and restrung at the rate of 5 shells per meter which is the ideal density for grow out.

Oyster rens for oyster spat settlement.

Mussel seeding

Mussel seeding

Mussel seed *i.e.* spat of 15-25 mm size were collected from natural beds were reattached to the polypropylene ropes for seeding and were suspended in water for grow out. Mussel ropes are prepared by enveloping the mussel spat on to nylon ropes and covered by cotton netting (mosquito nets) of 20-25 cm width and required length. The length of the rope depends on the depth of the culture area. Nylon ropes 16-18 mm are placed on the net cloth. Seed (2 to 2.5kg/m) are spread uniformly over the nylon rope and thereafter the cloth is wrapped over and stitched tightly with cotton thread such that the seed are covered over the rope. Bamboo pegs are inserted horizontally at regular intervals to prevent the slipping of the mussel seed. The seeded ropes are suspended from the raft/ rack. The cotton net disintegrates within 2-3 days by which time the mussel spat are firmly attached to the nylon rope.

Grow out farming

Construction of Racks

The suspended "Rack and Ren" farming method, advocated by CMFRI for the shallow areas in protected bays, lagoons and estuaries was adopted for bivalve farming in all the fishing villages. The racks for suspending the seeded ropes were installed where a minimum water height of 150 cm was available during low tide. Racks were constructed as a square platform using casuarinas and bamboo poles and these were fixed at 50cm above mean high tide level. A series of single beams are placed in a row. The crossbeam rack is constructed by placing cross bar on top of single posts and two long beams are secured on the end of cross beams. .Mussel seeds collected from natural beds were reattached to polypropylene/coir ropes and were suspended from fixed rack for grow out.

Seeded ropes of bivalves were suspended from fixed rack for grow out farming. Grow out period for the oyster farming is for about period of 7 to 8 months and for the green mussel farming is about 5 to 6 months when the conducive salinity prevails in the water body. Also cage farming of single oyster has been demonstrated to the beneficiaries. About 20-25 single oysters were being stocked in cage and allowed them to grow for 6 months. The cages were suspended from the racks. Growth of bivalve, water quality and farming raft were monitored periodically.

Rack and rope farming of Bivalve

Suspension of cages from racks

1.7. Farm Management

Cultured bivalves require a level of care to ensure their continued survival and growth to marketable size. Periodic checking of the farms is an integral point of culture management. The main management measures include are replacement of broken farm structure and re suspending loosened rens which touch the estuarine bottom. High mortality rates have been observed when the rens fall on the ground. Periodical cleaning of the oyster cages, either with a pump or swishing the trays up and down in the water to remove silt and fouling organisms is essential. Predators and fouler are also a menace to oyster farmers as they compete for space, food and oxygen with the oysters. It also increases the weight of the ren causing damage to the farm structure. So they should be controlled in periodic manner for their growth and survival. Large scale moralities of oysters due to the diseases caused by the fungus *Perkinsus marinus*, and the protozoan parasite *Minchinianel soni*, have been reported from temperate countries.

1.8. Harvest of the farming bivalves

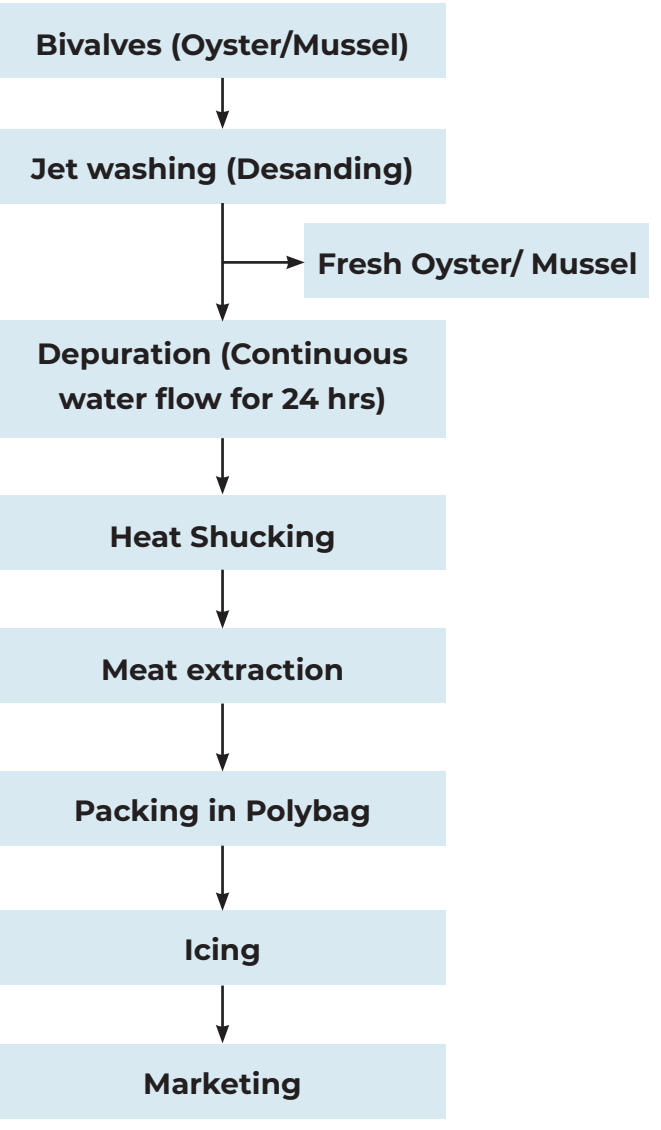
The oysters are harvested when the condition is high *i.e* with good meat condition. Generally high condition index is observed when the gonad is ripe prior to spawning. Harvesting is done manually one string after one by farmers.

1.9. Post harvest processes

Depuration

Bivalves are filter-feeding animals and accumulate pathogenic organisms from the water body in the gut of the oysters/mussels. These pathogens cause various health problem *viz*. members of the *Salmonella* group cause typhoid fever, while coliforms and vibrios cause gastroenteritis. By depuration, the microbial load is reduced to permissible levels, also faeces, sand particles and silt are removed from the alimentary canal of oysters. The oysters are placed for 24 hours in cleaning tanks under a flow of filtered seawater. About 10-20% of the seawater is continuously replaced. At the end of 12 hours, the water in the tank is drained and oysters are cleaned by a strong jet of water to remove the accumulated faeces. The tanks are again filled with filtered seawater and the flow is maintained for another 12 hours. Then the tanks are drained and flushed with a jet of filtered sea water. Then heat shucking is done to extract the meat from the oysters easily and the meat can be stored in polythene bags with ice for sale. The bivalve meat were stored in ice for maintaining the quality of the fish.

Flowchart of the postharvest processes for bivalves



2. BIVALVE FARMING IN THREE SELECTED VILLAGES

2.1. SENJIAMMAN NAGAR, Thiruvallur District

Integrated participatory bivalve farming demonstration was initiated in Senjaimman Nagar of Thiruvallur district by ICAR-CMFRI. The farm set up was established in Pulicat lake and the water body is highly productive for bivalve culture. The water body has extensive beds of oyster and green mussel. The average salinity of the water body is 32 ppt while average temp is about 33^{0}C which is highly conducive for bivalve growth. The training and demonstration for oyster and mussel farming was given to the beneficiaries selected from the village consisting of 20 members. Before starting the bivalve farming demonstration, a brief regarding the nutritional benefit of bivalves in their day to day life and economic benefit of bivalve farming was given to the beneficiaries by the CMFRI scientific person to create interest in them for bivalve farming Both men and women enthusiastically participated in the farming demonstration and completely involved in each step of farming *i.e* seed collection, making of rens, installation of raft, tying of rens, monitoring of growth, harvest and depuration of the bivalves.

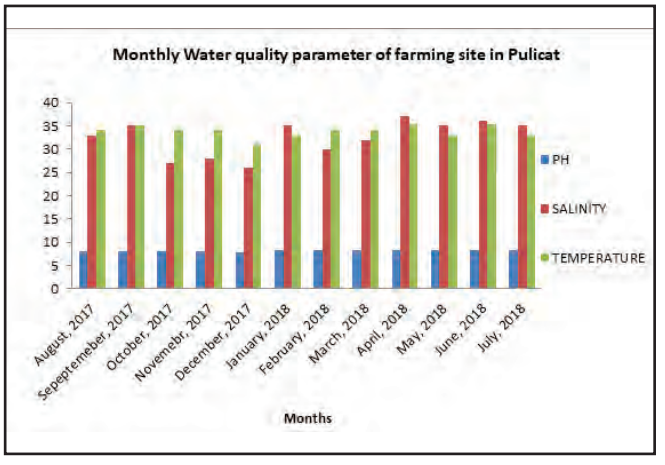
Selected Beneficiaries

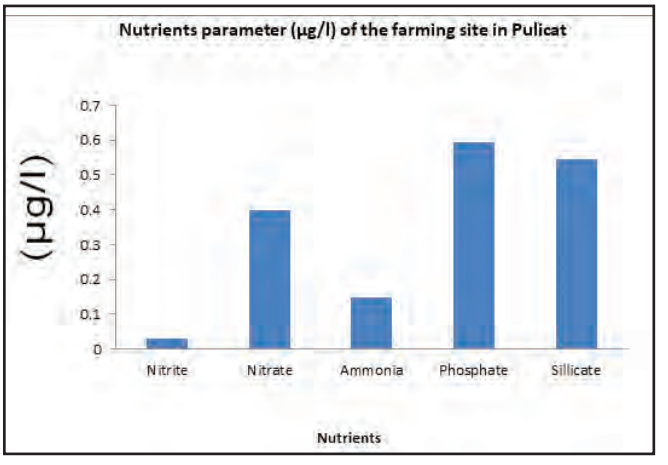
Following beneficiaries were selected from the village Senjiamman Nagar for bivalve farming.

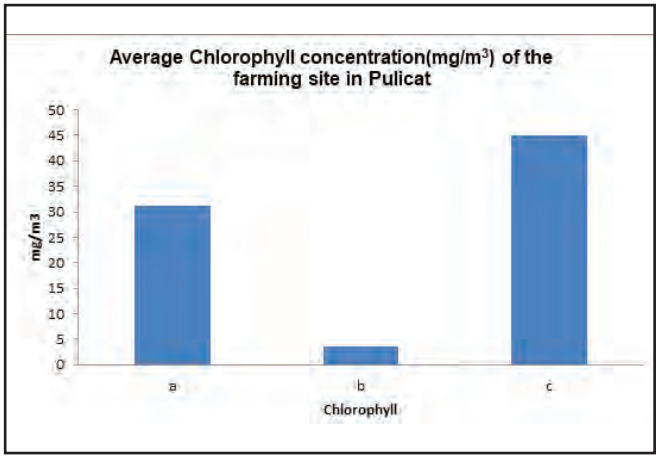
Sl.No.	MALE	FEMALE
1	C. Kuppa	Murugammal
2	Sankar	Alamelu
3	K.Suresh	Jaya
4	M.Munivel	Mariammal
5	K.Babu	Nagarani
6	G.Babu	
7	T.Anand	
8	R.Sonu	

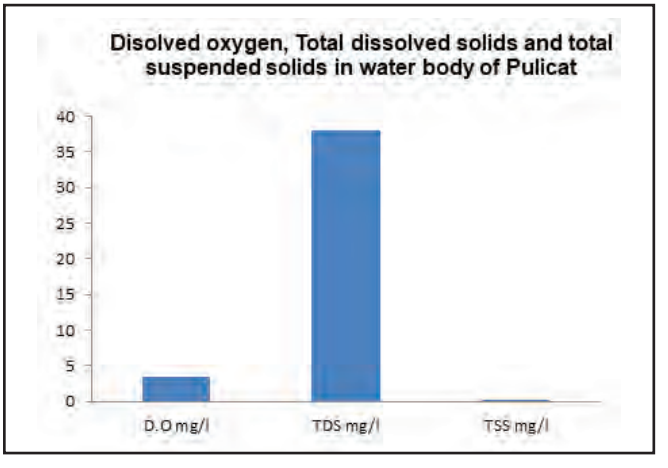
Sl.No.	MALE	FEMALE
9	T.K.Ramesh	
10	K.Balan	
11	R. Raja	
12	T.Gandhi	
13	T. Ramesh	
14	M. Kumar	
15	K.Lakshmanan	

Interaction with beneficiaries of Senjiamman Nagar









Monthwise variation in the water quality of the farming site in Pulicat

Farming demonstration

Bivalve farming Demonstration in Pulicat lake

The geographical location of the farming sites is 13^{0}01.243'N and 80^{0} 16.366' E. The suspended Rack and Ren method was adopted for demonstration of bivalve farming. The racks were suspended with seeded ropes of oyster and mussel and single oyster cages. Preparation of oyster rens for spat settlement has started on 1stDecember, 2017 and continued till February, 2018. All the beneficiaries were trained and very much involved in making rens. Mussels seed were collected from the intertidal areas of Pulicat lake, cleaned and segregated and packed in gunny bags to the farming site were used for mussel seeding purpose. The basic farm unit was 5m×5m square platform area and twenty such rack units were constructed for demonstration using bamboo and casuarinas poles and are fixed at 50cm above mean high tide level. 200 rens per one square platform racks were suspended from the racks for grow out in the month of April, 2018. The farming activity was delayed since there was delay in obtaining permission from forest department to carry out the farming demonstration. So, comparatively low spat fall intensity (3 to 5 spats/shell) was observed which may due to the time gap between instalment of rens and the breeding season of the oyster. Grow out period for the farming of bivalves is for seven months for oyster and 5 to 6 months for green mussel when conducive salinity prevails in the estuarine areas. The selected farming site had a moderate current with good primary productivity which is highly conducive for bivalve growth. Farm management was essential for the bivalve farming and it was limited to water quality monitoring, maintenance of raft and periodic inspection of ropes.

Farm dimension for demonstration

I unit (rack)	= 5 m × 5 m
No of rens per unit rack	= 200
Total unit of racks	= 20
Total no of rens	= 4000
No of cages	= 10

Construction of 20 racks (5 m×5 m) for bivalve farming in Pulicat

Drilling of empty oyster shell

Prepation of Rens

Seeding of ropes for mussel culture for suspension

Tying of Rens from the rack for spat settlement

Single oyster and single green mussel farming in cage

Natural oyster spat settlement on the empty oyster shell

Monitoring of growth of green mussel

Growth monitoring of Oyster

Harvest

A partial harvest was carried out to demonstrate the harvest as well as the post harvest protocol to the beneficiaries on 28 to 29 November, 2018. A total of 50 strings of oyster and 5 cages with single oyster were harvested for demonstration purpose. De-clumping, removal of byssus thread of mussels and grading of oyster and green mussels was carried out manually by fisherwomen of the village. Jet washing was done to clean the shells and to remove all the debris from the shells for hygienic purpose before taking measurements. Each string was consisting 9 to 12 numbers of live oysters and the average weight of each string was about 2.5kg with meat content 5.7%. The total production of oyster harvested from the strings was 61 kg while the quantity of the single oyster was 71kg. The meat content was 6.3% in oysters grown in cages to obtain single oysters with good rounded shapes. The quantity of mussel harvested was 30 kg and total meat extracted from this was 4 kg indicating edibility of 13%. The oyster spat of average size 2.5 mm attained an average size of 11.45 cm in 210 days (7 months) indicating an average growth rate of 13.14 mm/month while oyster spat of average size 15mm attained an average size of 12.57 mm in 210 days indicating a growth rate of 15.81 mm/month in cages. The mussels also grew up to an average size of 58 mm within same period. The count of oyster per kg was 5 numbers and while the count of green mussel was 28 numbers per Kg

Harvesting of Oyster strings

Harvested single oysters from Pulicat

Harvested Oyster strings

Harvested Green mussel from Pulicat

Demonstration of Post-harvest processes

Hands on training on depuration was given to the beneficiaries to remove the bacterial contaminant from the bivalves which will enhance the quality of the meat which increases the market value of meat . A temporary depuration facility was set up to demonstrate the depuration process. The unit has specially designed tanks with slope, inlets and outlets. The water is filtered by passing it through cartridge filters (300µ). The model depuration plant aims to supply quality oysters to the public and market. The harvested bivalves were kept in clean sea water for 24 hours for depuration. All the farmed bivalves were heat shucked after being depurated, thus ensuring the good quality of the meat. Thereafter, meat was extracted and kept in ice ready for the market. A total of 12 Kg of meat was extracted, of which 4 Kg of green mussel meat and 8 Kg of oyster meat was obtained. They were sold at Rs.200/Kg and the money was handed over to the beneficiaries.

Jet washing of harvested oysters and green mussel

Beneficiaries involved in cleaning of oysters and green mussels in Senjiamman Nagar

Temporary Depuration unit established in Senjiamman Nagar for demonstration purpose

Handing over the harvested bivalves to the beneficiaries by DoF

Distribution of Certificate to the beneficaries

Demonstration of heat shucking of edible oyster and green mussel

Extraction of meat

Selling of oyster meat

Handing over the money to the beneficiaries

2.2. KOTTAIKADU VILLAGE Kancheepuram District

Beneficiaries selected for Farming demonstration in Kottaikadu

Integrated participatory bivalve farming demonstration was initiated in Kottaikaduvillage of Kancheepuram district by Madras Research Centre, ICAR-CMFRI, Chennai. The farm set up was established in the southern part of Buckingham canal flowing through the Kottaikadu village. The water temperature and salinity in this shallow water body ranged is 31.8^{O} to 34.2^{O}C and 25 to 35 ppt respectively which is highly conducive for bivalve growth. The water body is endowed with the extensive beds of oyster, green mussel and other bivalves and a very good oyster fishery prevails throughout the year. The demonstration for oyster farming was done by involving the beneficiaries in each step of the farming process. The selected beneficiaries comprised of 42 women. Before initiating bivalve farming demonstration, a brief regarding the nutritional benefit of bivalves in their day to day life and economic benefit of bivalve farming was given to the beneficiaries by the CMFRI team to create interest in them. All women enthusiastically participated in the farming demonstration and completely involved in each step of farming *i.e* seed collection, making of rens, installation of raft, tying of rens, monitoring of growth, harvest and depuration of the bivalves. Though only oyster farming demonstration was aimed for this site, a very good spat settlement of green mussel was observed on the oyster rens as well as the edges of the single oyster cages indicating a highly productive water body for farming both oysters and green mussels.

Beneficiaries

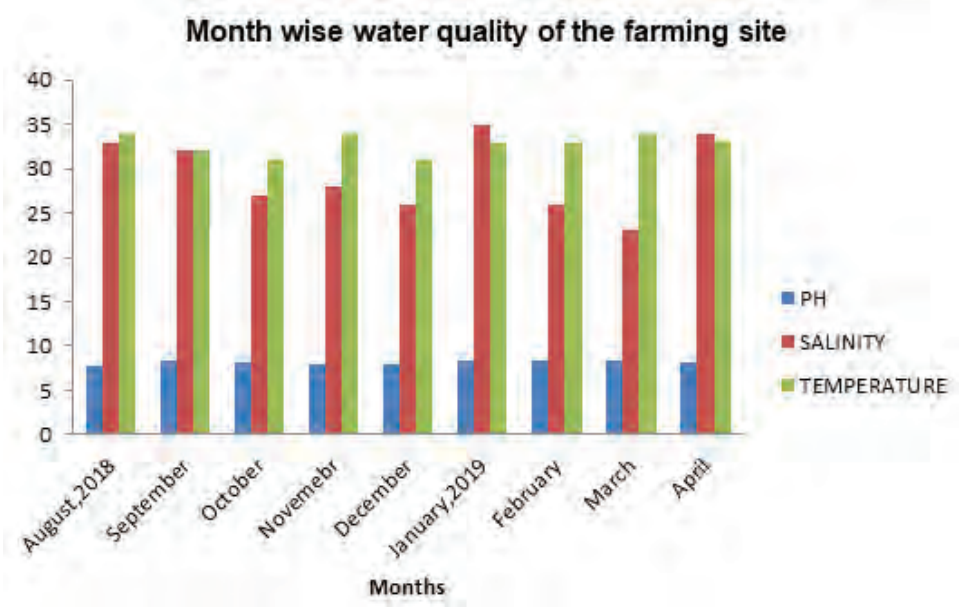
Following beneficiaries were selected from the Kottaikadu village, for bivalve farming demonstration.

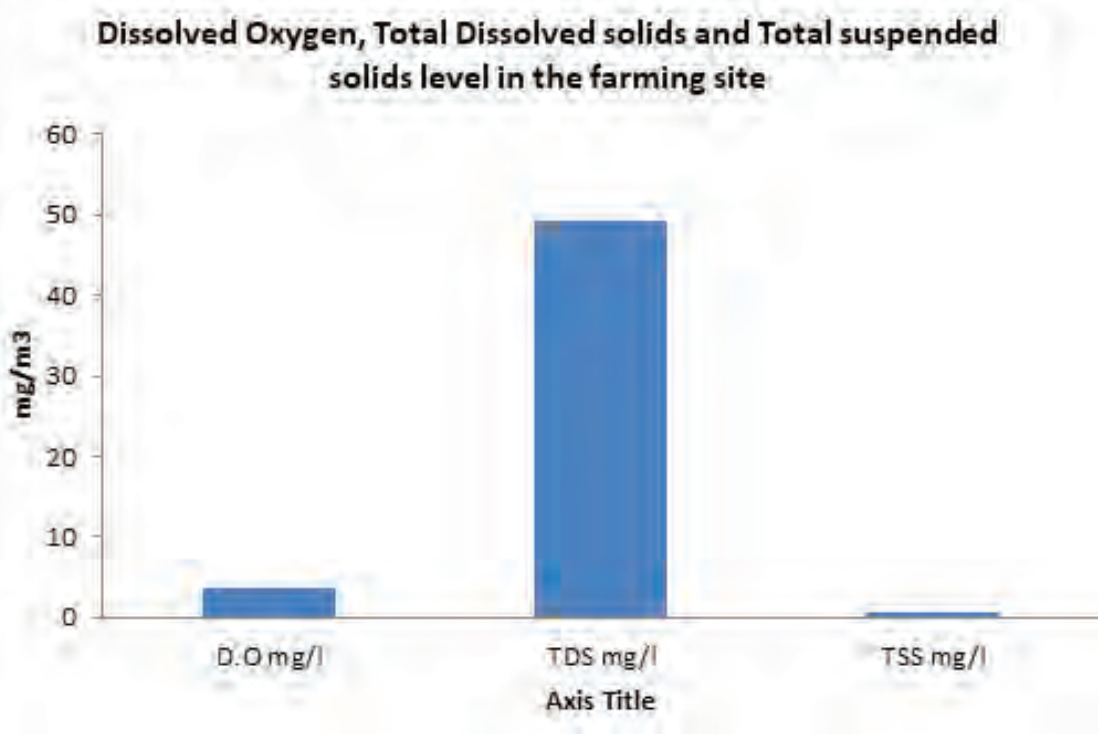
SL. No.	Beneficiaries (Women)	SL. No.	Beneficiaries (Women)
1	Anjugam	22	Sathya Rani
2	Kalpana	23	Gomathy
3	Laxmi	24	Bhavaneshwari
4	Sheela	25	Amulu
5	Andal	26	Chandra
6	A.Devi	27	Meena
7	Vijayalakshmi	28	Ambika
8	GyanaSundari	29	Manjula
9	Jeya	30	B.Shanthi
10	K.Shanthi	31	Meenakumari
11	Vimala	32	R.Shanthi
12	Pushpa	33	Indira
13	Janaki	34	Boopathy
14	Muthuvalli	35	Mariyamma
15	Devi	36	S.Meera
16	Komala	37	Muthulakshmi
17	Bhavani	38	Sarasu
18	Vennila	39	P.mariammal
19	Mangala	40	Devaiyani
20	Inbavalli	41	Nadhiya
21	Anjalai	42	Vljaya

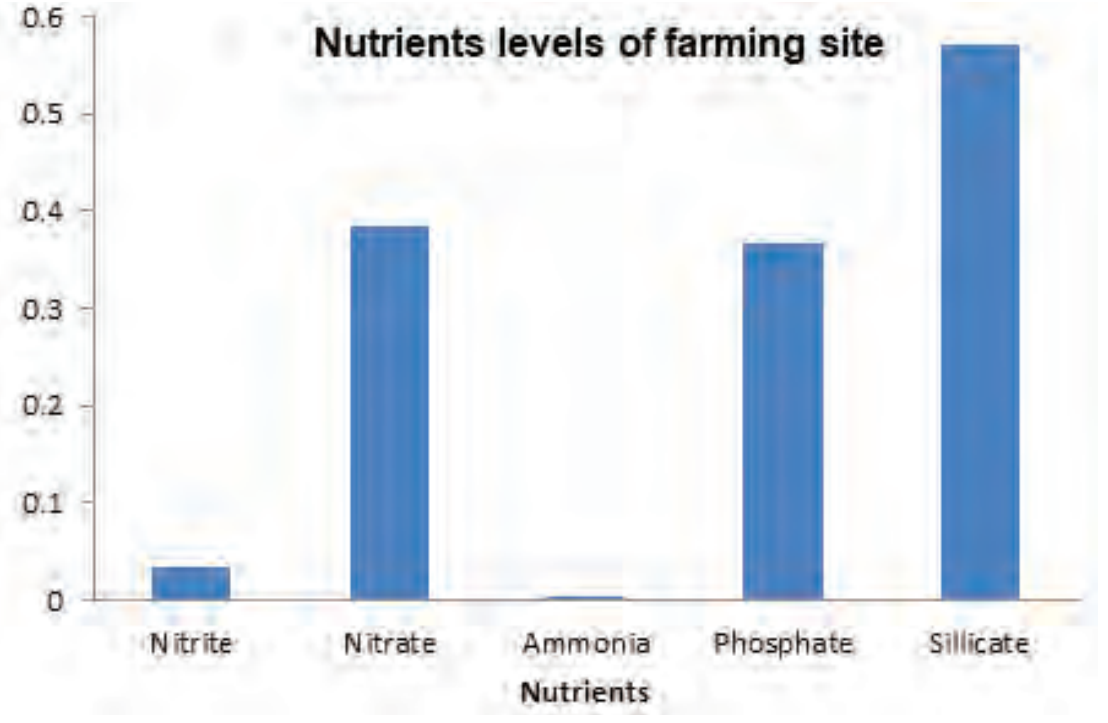
Interaction with beneficiaries of Kottaikadu

Farming demonstration

The geographical location of the farming site is 12^{0}15.343'N and 80^{0} 00.087' E. The suspended Rack and Ren method was adopted for demonstration of oyster farming. The racks were suspended with seeded ropes of oyster and single oyster cages. Preparation of oyster rens for spat settlement was initiated has started on 1st Decemebr, 2017 and continued till February, 2018. All the beneficiaries are well trained and very much involved in making of rens. The basic farm unit was 5m×5m square platform area and twelve such rack units were constructed for demonstration using casuarinas poles, fixed at 50cm above mean high tide level. 200 rens per one square platform racks were suspended from the racks for grow out in the month of August, 2018. Also 12 cages stocked with 70 to 75 numbers of oyster spat were suspended in the farms for demonstration of single oyster production. Very good spat settlement of green mussel spat along with oyster was observed on the oyster rens and on the edges of the oyster cages. The culture duration was 8 months. The selected farming site had a moderate current with good primary productivity which is highly conducive for bivalve growth. Farm management was essential for good growth of oyster in bivalve and it was limited to water quality monitoring, maintenance of raft and periodic inspection of ropes to remove fouler. The month wise variation in water quality parameter has been given below.




Dissolved Oxygen, Total Dissolved solids and Total suspended solids level in the farming site
60
50
40
30
20
10
0
mg/m3
D.O mg/l
TDS mg/l
TSS mg/l
Axis Title


Nutrients levels of farming site
0.6
0.5
0.4
0.3
0.2
0.1
0
Nitrite
Nitrate
Ammonia
Phosphate
Sillicate
Nutrients

Construction of racks

Integrated Bivalve farm set up in Kottaikaddu

Demonstration of making Oyster rens

Oyster rens made by the beneficiaries

Securing of oyster rens from racks @ 200 rens/1 rack units

Collection of oyster seed for stocking in Oyster cage

Stocking of 20-25 oyster spats for producing single oysters

Installation of 12 cages from 2 rack units

Natural green mussel spat settlement on farm structures indicating an ideal site for mussel farming

Natural green mussel spat settlement on the oyster rens

Fully grown green mussel in the farming

Fully grown edible oyster in the farming

Harvest

Attached green mussel on the oyster cages while harvesting

A partial harvest was carried out to demonstrate the harvest as well as the post harvest protocol to enhance the quality of the meat by removing all the bacterial contaminants from the bivalve meat on 25th to 26th April, 2019. Harvest was delayed due to some political and social issues at the time of election and because of this delay some of the farm structures were drowned due to which there was mortality of farmed oysters. A total of 25 strings of oyster and 8 cages with single oyster were harvested for demonstration purpose and other rafts were handed over to the beneficiaries. De-clumping, removal of byssus thread of mussels and grading of oyster and green mussels was carried out manually by fisherwomen of the village. Jet washing was done to clean the shells and to remove debris on the shell. Even though 20 to 30% mortality of oyster and green mussel was observed due to sinking of oyster rens and cages, a very good quality meat as well as quantity of meat was harvested from this site. Each string was consisting 11 to 15 numbers of live oysters and average weight of each string weighed about 2.5 kg. The average meat content of oyster from strings was 11.5%. The total production of oyster harvested from the strings was 95 kg while the quantity of the single oyster was 97kg. The meat content was 9% in oyster cages. The quantity of mussel harvested was 45.57kg and total quantity of mussel meat extracted was 12 kg indicating edibility of 26%. The oyster spat of average size 2.5 mm attained a average size of 11.45 cm in 240 days (8 months) periods indicating an average growth rate of 14 mm/month while oyster spat of average size 13.5 mm attain a average size of 13.15 cm in 240 days indicating a growth rate of 14.75 mm/month in cages. The mussels also grew a average size of 65 mm within same period. The average count of oyster per kg was 4 while the count of green mussel per kg was 22 numbers.

Jet washing

Cleaning of oysters and green mussels

Temporary depuration unit established during harvest in Kottaikadu

Harvest function held in Kottaikadu

Handing over the farmed bivalves to the beneficiaries.

A pamphlet entitled “Bivalve- a promising food for a healthy life” in Tamil released for creating awareness for including bivalves in their daily diet.

Demonstration of Post harvest processes

Hands on training on depuration were given to the beneficiaries for understanding the necessity of depurating bivalves before consumption and process through which microbial contents of the gut are removed. A temporary depuration facility was set up to demonstrate the depuration procedures. The unit has specially designed tanks with slope, inlets and outlets. The water is filtered by passing it through cartridge filters (300µ). The model depuration plant aims to supply quality oysters to the public and market. The harvested bivalves were kept in clean sea water for 24 hours for depuration. All the farmed bivalves were heat shucked after being depurated, thus ensuring the good quality of the meat. Thereafter meat was extracted and kept in ice before going to market. A total of 31 kg of meat containing 12kg of green mussel and 19 kg of oyster were extracted from the shell. They were being sold at Rs.200/kg and the money was handed over to the beneficiaries.

Heat shucking of farmed oyster and green mussel

2.3. CUDDALORE CHINNA KUPPPAM

Kancheepuram District

Integrated participatory bivalve farming demonstration was initiated in Cuddalore Chinna kuppam village of Kancheepuram district by Madras Research Centre, ICAR-CMFRI, Chennai. The farm set up was established in the southern part of Buckingham canal. The water temperature and salinity in this shallow water body ishighly conducive for bivalve growth. The water body is endowed with the extensive beds of oyster, green mussel and other bivalves. A total of 8 rafts with 200 oyster rens per raft was installed December, 2017 for the demonstration purpose. Twenty beneficiaries (men) were selected from the village. A brief regarding nutritional benefit of bivalve in their daily diet and economic benefit was given to the beneficiary to create interest and awareness about bivalve farming among them. At first beneficiaries were very much interested in the faming activities. But it is very disheartening that beneficiaries lost their interest in bivalve farming after some point of time since they were more interested in fishing which was fetching them their daily income. As the beneficiaries were not involved fully the farming activity was neglected and hence did not flourish up to the expectation.

Beneficiaries

Following beneficiaries were selected from the Cuddalore Chinna Kuppam village, for bivalve farming.

Sl. No	Beneficiaries	Sl. No	Beneficiaries
1	K.Sambath	11	M.Mathivanan
2	U.Vinothkumar	12	K.Dinesh
3	C.Sethu	13	K.Ajithkumar
4	B.Sridhar	14	S.Deepan
5	S.Desappan	15	K.Vignesh
6	R.Kishore	16	D.Premkumar
7	M.Praveen	17	S.Kaamesh
8	A.Ajithkumar	18	D.Naresh
9	M.Navankumar	19	R.Abinesh
10	G.Dinesh	20	R. Viji

Preparation of Rens for oyster farming

Construction of Racks

3. FARMING DETAILS AND ECONOMICS

Complete details of the farming demonstration in Senjiamman Nagar and Kottaikadu villages

1. **Oyster farming**

Details	Senjiamman Nagar	Kottaikadu
Geographic location	13°01'243''N 80°16'336"E	12°15'334''N 80°00'087"E
No of beneficiaries	20 (men & women)	42 (women)
No of raft	20	12
Oyster rens/raft	200	200
Total number of rens	4000	2400
Stocking of oyster rens for spat collection	April,2018	August,2018
Spat fall intenisity	3-5 nos per shell	4-8 nos per shell
Harvest	28th and 29th Novemeber,2018	25th and 26th April,2019
Grow out period	7 months	8months
Total number string harvested on 28th& 29th Novemebr,2019	36	25
Total weight of oyster string	61 kg	113 kg
Production/oyster string	2.5 kg	4.5 kg
Anticipated total production from the oyster string (Average weight of one oyster string×total number of oyster rens)	2.5kg ×4000 =10000Kg	4.5kg×2400=96000Kg
Total meat from the oyster strings	3.5kg	11.61kg
Income generated during partial harvest	700	2322
Edibility	5.7%	11.61
Total anticipated income generation(Rs.)	1,14000	237,600

2. **Single oyster farming**

Details	Senjiamman Nagar	Kottaikadu
No of cages	10	17
Oyster spat/cages	60-65	65-70
Size of spat	10-15 cm	10-17cm
Month of stocking	April, 2018	August, 2018
Partial harvest	5 cages	4 cages
Total quanity of oyster harvested	71 Kg	97 Kg
Total meat extracted from the oyster cages	4.5 Kg	8 Kg
Income generated during partial harvest	900	1600
Edibility	6.3%	8%
Total anticipated production	142 Kg	412.25 Kg
Total anticipated income generation (Rs.)	1789	6596

3. **Mussel farming**

Details	Senjiamman Nagar	Kottaikadu
Nature of seeding of mussel	Seeded ropes mussel (3) +Natural spat settlement on the Oyster string	Natural spat settlement on the oyster string and oyster cages
No of green mussel ropes	3	nil
Total quantity in partial harvest	30	45.57
Meat extracted from partial harvest	4 Kg	12 Kg
Edibility	13.3%	26%
Income generated during partial harvest	800	2400
Anticipated production(Rs.)	**8000**	**24000**

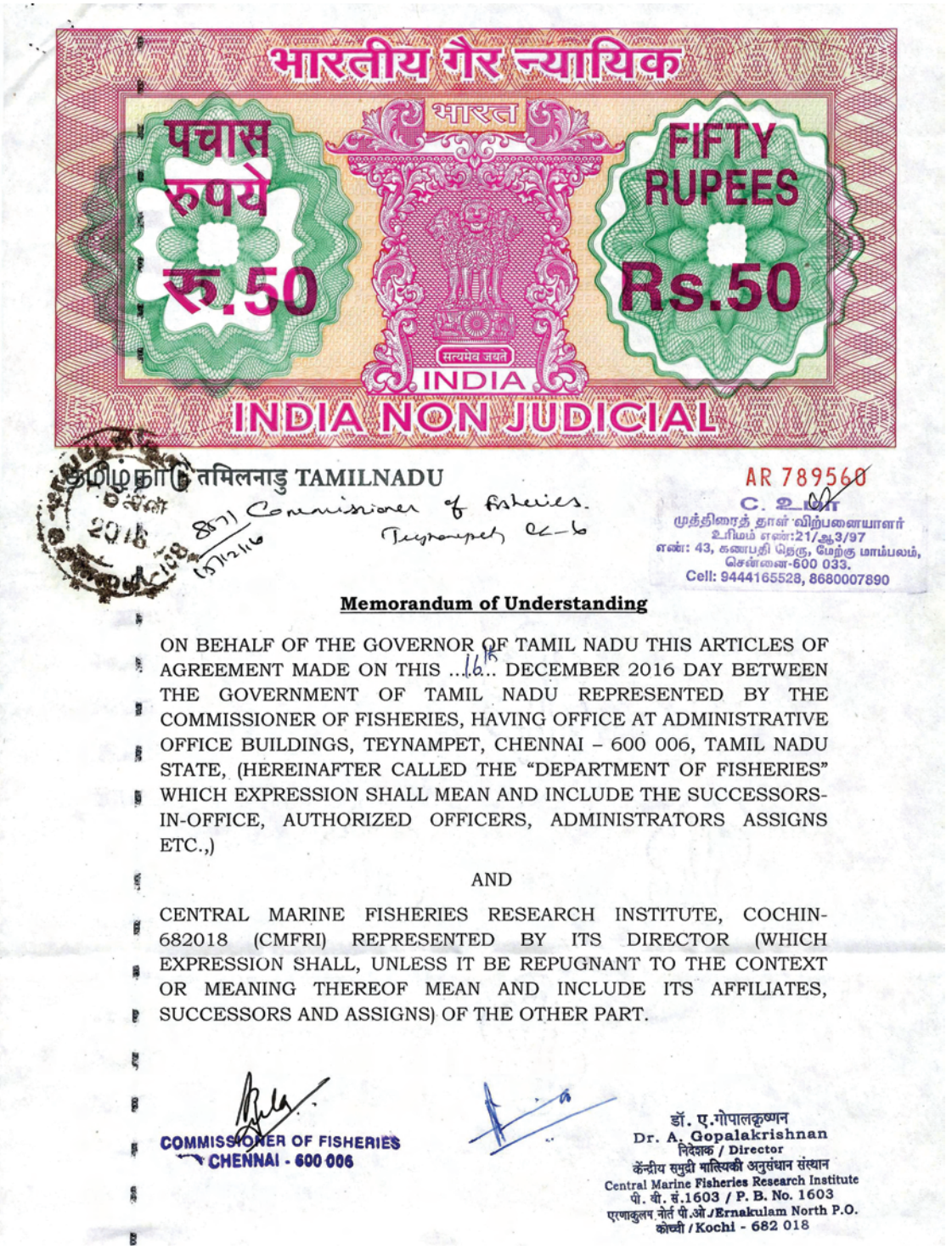
4. Economics of bivalve farming (One raft is 5m×5m)

The economics of bivalve farming (oysters and mussels) were worked out based on our field study. It was found that the total expenditure per raft in Pulicat worked out to Rs.5,125 while it was Rs.5,475 at Kottaikadu. The gross revenue per raft was higher in Kottaikadu at Rs.19,817 per raft than in Pulicat (Rs.6,460 per raft). This is mainly due to the meat recovery percentage of the oysters grown in Pulicat (which is 6%) and in Kottaikadu (it was 10%). The profit per raft worked out to Rs.1,335 in Pulicat and Rs.14,432 in Kottaikadu. Thus the total revenue generated from Pulicat was lower (Rs.26,700/-) than at Kottaikadu (Rs.1,72,104). Accordingly the profit percentage also varied from 20.6% at Pulicat to 72.3% at Kottaikadu. This variation in profit percentage is due to the difference in the meat recovery percentage which is varied from 65 in Pulicat to 10% in Kottaikadu.

(Value in Rupees per raft)

Sl.No.	Components of farming	Pulicat	Kottaikadu
1	Number of rafts installed	20	12
2	Installation charges	4,000	4,000
3	Operating expenses (ren, maintenance, raft construction, harvest and related expenses)	1,125	1,475
4	Total expenditure	5,125	5,475
5	Gross Revenue (oyster meat,)	1,21,200	2,13,800
	Gross Revenue (mussel meat)	8,000	24,000
	Gross revenue	1,29,200	2,37,800
7	Gross revenue per raft	6,460	19,817
	Profit per raft (6)-(4)	1,335	14,342
8	Total profit	26,700	1,72,104
9	Profit percentage	20.6%	72.3%

4. MOU BETWEEN DEPARTMENT OF FISHERIES, GOVERNMENT OF TAMIL NADU AND CMFRI



भारतीय गैर न्यायिक

पचास रुपये रु.50

भारत

FIFTY RUPEES Rs.50

सत्यमेव जयते

INDIA

INDIA NON JUDICIAL

தமிழ்நாடு तमिलनाडु TAMILNADU

AR 789560

Commissioner of Fisheries. Teynampet, CC-6

C. உமா
முத்திரைத் தாள் விற்பனையாளர்
உரிமம் எண்:21/ஆ3/97
எண்: 43, கணபதி தெரு, மேற்கு மாம்பலம்,
சென்னை-600 033.
Cell: 9444165528, 8680007890

Memorandum of Understanding

ON BEHALF OF THE GOVERNOR OF TAMIL NADU THIS ARTICLES OF AGREEMENT MADE ON THIS ...16th.. DECEMBER 2016 DAY BETWEEN THE GOVERNMENT OF TAMIL NADU REPRESENTED BY THE COMMISSIONER OF FISHERIES, HAVING OFFICE AT ADMINISTRATIVE OFFICE BUILDINGS, TEYNAMPET, CHENNAI – 600 006, TAMIL NADU STATE, (HEREINAFTER CALLED THE "DEPARTMENT OF FISHERIES" WHICH EXPRESSION SHALL MEAN AND INCLUDE THE SUCCESSORS-IN-OFFICE, AUTHORIZED OFFICERS, ADMINISTRATORS ASSIGNS ETC.,)

AND

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN-682018 (CMFRI) REPRESENTED BY ITS DIRECTOR (WHICH EXPRESSION SHALL, UNLESS IT BE REPUGNANT TO THE CONTEXT OR MEANING THEREOF MEAN AND INCLUDE ITS AFFILIATES, SUCCESSORS AND ASSIGNS) OF THE OTHER PART.

COMMISSIONER OF FISHERIES
CHENNAI - 600 006

डॉ. ए.गोपालकृष्णन
Dr. A. Gopalakrishnan
निदेशक / Director
केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान
Central Marine Fisheries Research Institute
पी. बी. सं.1603 / P. B. No. 1603
एरणाकुलम नोर्थ पी.ओ./Ernakulam North P.O.
कोच्ची / Kochi - 682 018

Hereinafter, Fisheries department and Central Marine Fisheries Research Institute are collectively known as the "Department" and the "CMFRI"

Whereas CMFRI has submitted a proposal for conducting ("The Project") and the Client has agreed to the proposal on the terms and conditions detailed below herein which parties have agreed to do; now therefore the parties hereto agree as follows.

Clause 1: Description of Project: - CMFRI shall conduct the ("The Project") as described in the proposal prepared and submitted by CMFRI and modified and agreed by the Fisheries Department which is appended to the agreement as "A". CMFRI will carry out the project as per the evaluation design, framework and implementation plan in this proposal. Any modifications to the proposal hereafter that materially impact upon the project should be reciprocally agreed between CMFRI and the Fisheries Department.

Component ii Bivalve farming

To study the demand and market potential of edible oysters and green mussel in local and outside markets.

To identify suitable sites for farming and spat collection and decide on the seasons of operations and marketing options.

To identify suitable beneficiaries for carrying out the farming demonstrations in a systematic manner and develop supply chain for the value addition and marketing.

To improve the economic and nutritional livelihood requirements for the coastal folks

ICAR- Central Marine Fisheries Research Institute (ICAR-CMFRI) proposes to undertake the task of capacity and skill enhancement at beneficiary level whilst finalizing the suitable sites in the coastal districts mentioned.

While building up the capacity and skills of personnel identified by ICAR-CMFRI, the infrastructure like depuration facility and holding tanks and farming estuaries and backwaters are to be facilitated by the Tamil Nadu Fisheries Department.

Component iii

To develop a scientific sampling plan for estimating marine fish landings, fishing effort and primary market value of marine fishery resources for the notified centers in Tamil Nadu.

To develop a core team for institutionalization of the estimation procedure at Tamil Nadu Fisheries Department.

To establish a database serving mechanism with networked input/output and marine Fish landings estimates reporting facilities.

ICAR- Central Marine Fisheries Research Institute (ICAR-CMFRI) proposes to undertake the task of capacity and skill enhancement at Tamil Nadu Fisheries Department whilst finalizing marine fisheries landings estimates of the designated 38 marine fish landings centers identified by Tamil Nadu Fisheries

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Department under the following modalities of implementation and coordination.

While building up the capacity and skills of personnel identified by Tamil Nadu Fisheries Department for this, ICAR-CMFRI would wholly retain the following responsibilities towards finalizing the estimated landings of the 38 designated centers during the course of the project :

a. Preparation of data collection work programmes for each calendar Month for the field staff (13 nos) appointed under FIMSUL scheme.
b. Training shall be provided to 13 data collections assistants and other Inspector of Fisheries / Sub Inspector of Fisheries working in the 13 coastal districts.
c. The final data analysis after pooling the collected survey details will be carried out jointly by both FIMSUL (Fisheries Department) & ICAR-CMFRI staff.
d. Supervision of data collection and inspections have to be planned and executed jointly; Necessary follow-up actions based on inspections have to be taken by Tamil Nadu Fisheries Department /FIMSUL for maintaining quality and authenticity of collected data
e. While the estimates of landings of 38 designated marine fish landings centers would be arrived at based on the pooled survey data, the landings centers being covered in the sampling scheme of ICAR-CMFRI will be done separately by CMFRI so as to complete the official statistics for the whole state. The estimates would be provided by ICAR-CMFRI through permissions from the database server of the institute .The marine fish landings estimates pertaining to 38 landings centers identified by Tamil Nadu Fisheries Department will be common to both ICAR-CMFRI and Tamil Nadu Fisheries Department.
f. The summary formats to be finalized for publications onto government portals for general public may be on mutual consensus as beyond certain granularity ICAR-CMFRI data dispensation policies restrict free sharing.
g. Tamil Nadu Fisheries Department shall ensure the continuation of the data collection programme in the same manner as being executed during this collaboration after the completion of FIMSUL Project.
h. Broadly the activities and component-wise responsibilities as well as budgetary requirements and timeline given in the document may have to be best adhered to; any short comings possible course correction rising thereof may be addressed to based on sittings of the coordination team to be convened on as and when basis.
i. To include Development of a mobile app for providing catch data instantly.
j. Providing the basic fish catch statistics of Tamil Nadu compiled on monthly basis to Fisheries department for ready reference and preparation of projects and for uploading in Fisheries Website

Clause 2: Research Personnel and Performance: - CMFRI use the service of the skilled and competent from within and outside the institution for carrying out the project with professional perfection. CMFRI shall carry out the project with due diligence and efficiency and furnish to the client such information related to the project as the Client may from time to time reasonably request.

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एरणाकुलम नॉर्थ पी.ओ./Ernakul

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Clause 3 : Report:- CMFRI shall submit the Result based Monitoring and Evaluation Reports in two stages viz; six monthly review reports and final evaluation report in English language in three copies each.

Clause 4: Commencement Date:- CMFRI shall commence the project immediately after signing the agreement and the disbursal of the first instalment. However the works carried out before the date of this agreement in connection with the project, after receiving the Sanction order from the Fisheries Department with specific instruction also will covered under this agreement.

Clause 5: Maximum Agreement Amount:- Not withstanding any other provisions of this Agreement, except as may be otherwise agreed, the Fisheries Department shall pay CMFRI for the project an amount of Rs.**45.12 Lakhs (Forty five lakhs and twelve thousand only)** (component II) and **Rs 98.00 Lakhs (Ninety eight lakhs only)(component III)** including all tax and other costs incurred in connection with the project (component II and III). **The total costs include the cost for survey Rupees 5 Lakhs, equipments for Rupees 14.5Lakhs, FRP tanks worth Rs 1.2 lakhs and a recurring cost of 3 unskilled persons (preferably from the beneficiary community) Rs 10.8 Lakhs** under **component II** and **Rupees twenty four lakhs for training** and **thirty two lakhs for developing expertise in fish landing data enumerators and analysts, rupees eight lakhs for the operating systems and two lakhs for the software support** system which will be primarily to enable CMFRI to create the platform for data generation and analysis by equipping the staff and (Tamil Nadu Fisheries Department) personnel under component III. The administrative expenses of (**Rupees Seventeen lakhs thirty six thousand, inspection and monitoring charges (Travel allowance -Rupees twenty lakhs) and other miscellaneous expenses (Rupees eleven lakhs**) which are the essentials for the Institute to carry out the field level demonstrations involving the experts and trainers for both the components II and III, and submission of periodic progress reviews and reports .

Clause 6: Payment to CMFRI:- The Client shall pay CMFRI for the project on the basis of claims submitted by CMFRI to the Client in accordance with the payment Schedule shown below.

Payment Schedule
Component II

No	Time of Payment	Amount to be released
1.	At the time of MOU with CMFRI and Fisheries Department	**(Rs.22,56,000)Rupees Twenty two lakhs fifty six thousand only** (50% of the agreed Project Agreement amount)
2.	At the time of mid-term progress(6 months)	**(Rs.13,53,600) Rupees Thirteen lakhs fifty three thousand and six hundred only** (30% of the agreed Project Agreement amount)
3.	At the time of submission of the final report	**(Rs.9,02,400) Rupees Nine lakhs two thousand and four hundred only** (20% of the agreed Project Agreement amount)

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The costs for the rafts and culture platforms in the water bodies are to be erected by the beneficiary under the support provided by the Tamil Nadu Fisheries Department. (Rs 12.00 Lakhs)

The primary facility for the depuration to be created by the Tamil Nadu Fisheries Department at the various sites identified by CMFRI (Rs 6.00 lakhs)

Component III

No	Time of Payment	Amount to be released
1.	At the time of MOU with CMFRI and Client	**(Rs.66,50,000)Rupees Sixty six lakhs fifty thousand only** (67.8% of the agreed Project Agreement amount)
2.	At the time of mid-term progress(6 months)	**(Rs.28,10,000) Rupees Twenty eight lakhs ten thousand only** (28.7% of the agreed Project Agreement amount)
3.	At the time of submission of the final report	**(Rs.3,40,000) Rupees Three lakhs forty thousand only** (3.5% of the agreed Project Agreement amount)

Payment schedules Component III				
	Schedule-1	**Schedule-2**	**Schedule-3**	**Total**
Training	24.0			**24.0**
Software	2.0			**2.0**
Manpower	16.0	16.0		**32.0**
TA	8.0	7.0		**15.0**
Hardware	8.0			**8.0**
Misc	2.5	1.5	1.0	**5.0**
Adm	6.0	3.6	2.4	**12.0**
Total	**66.5**	**28.1**	**3.4**	**98.0**

To establish the data collection system so as to ultimately benefit the stake holders, necessary training on species identification and marine fish landings data collection have to be given to the 13 field staff appointed under FIMSUL in order to develop the necessary skill for collection of information. To start the project entire expenditure towards training, software and hardware components needs to be obtained in the initial stage itself.

COMMISSIONER OF FISHERIES
CHENNAI - 600 006

डॉ. ए.गोपालकृष्णन
Dr. A. Gopalakrishnan
निदेशक / Director
केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान
Central Marine Fisheries Research Institute
पी. बी. सं.1603 / P. B. No. 1603
एर्णाकुलम नॉर्थ पी.ओ./Ernakulam North P.O.
कोच्ची / Kochi - 682 018

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All payments under this Project Agreement shall be made to the following account(s) of CMFRI:

ICAR Unit- CMFRI
Current AC/No: 10626732724
Type of Account : Current Account
Name of the branch : State Bank of India, Main Branch
KTDC Building, Ernakulam,682018.

Clause 7 : Ethics in Implementing the :- CMFRI shall carry out the project in accordance with the highest standards of professional and ethical competency and integrity, having due regard to the nature of purpose of the and shall ensure that the staff assigned to perform the services under this agreement, will conduct themselves in a manner consistent herewith.

Clause 8: Sub-Contracting:- CMFRI may subcontract the work relating to the project to an extent and with such specialists and professional entities as per the prevailing norms of CMFRI if necessary for the successful completion of the project. Notwithstanding this clause, CMFRI shall retain full responsibility for the services and for the content of all reports and other deliverables require hereunder. In the event that any sub-contractor is found by the client to be incompetent or incapable in discharging assigned duties, the Client may request CMFRI to provide a replacement forthwith.

Clause 9: Ownership of Reports:- All the Reports or work products, in any form, prepared by CMFRI in performing the shall be the sole and exclusive property of the Fisheries Department and may be available to the general public at the Fisheries Department's sole discretion. However CMFRI can use such documents and data for academic and research purposes.

Clause 10: Suspension: -

The Fisheries Department may by notice to CMFRI, suspend in whole or in part, the disbursement of funds if CMFRI shall have failed to carry out any of its obligations under this Project Agreement, or any condition has arisen which, in the reasonable opinion of the Fisheries Department, interferes, or threatens to interfere, with the successful carrying out of the services the accomplishment of the this agreement.

Clause 11: Termination: -

(a) The Fisheries Department may terminate this Agreement by notice to CMFRI 14 calendar days after the Fisheries Department has given notice to CMFRI of suspension of payments under this Agreement. (b) CMFRI may, by notice to the Fisheries Department, terminate this Agreement, if payments are not received within calendar days after the due date pursuant to the Payment Schedule specified and such default has not been remedied within 10 calendar days after notice has been given by CMFRI.

Clause 12: Intellectual Property Rights:-

(a) CMFRI shall indemnify the Fisheries Department from against any and all claims, liabilities, obligations,; losses, damages, penalties, actions, judgments, suits, proceedings, demands, costs, expenses and

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disbursements of whatsoever nature that may be imposed on, incurred by or asserted against, the Fisheries Department during or in connection with this by reason of (i) infringement or alleged infringement by CMFRI of any patent or other protected right, or (ii) plagiarism or alleged plagiarism by CMFRI.

Clause 13: Relationship of Parties:-

(a) Nothing contained in this agreement shall be construed as establishing or creating between the Fisheries Department and CMFRI a relationship of master and servant or principal and agent. (b) CMFRI shall during the performance of the services be an independent authority retaining complete control over its personnel, conforming to all statutory requirements with respect to all its employees, and providing all appropriate employee benefits.

Clause 14: Settlement of disputes:- If any dispute or difference arises between the parties over works relating to any aspects of this Agreements, the parties shall first attempt to settle the dispute through mutual and amicable consultation. If the dispute is not settled through such diligence and efficiency and shall furnish to the Client such information related to the project as the Client may from time to time reasonably request.

For the Fisheries Department

(Beela Rajesh)
Commissioner of Fisheries
DMS Compound, Teynampet,
Chennai-600 006
Email: tnfimsul@gmail.com

For the CMFRI Team

(A. Gopalakrishnan)
Director
Central Marine Fisheries
Research Institute,
Cochin-682018

Witness

Additional Director of Fisheries
(CDRRP - FIMSUL - II)
Office of the Commissioner of Fisheries
Chennai-600 006.

Witness

C R. NARAYANA KUMAR
प्रभारी वैज्ञानिक / Scientist-in-Charge
पी.एम.इ.सेल / PME Cell
सी.एम.एफ.आर.आइ / C. M. F. R. I.
कोच्ची - 18 / Kochi - 18

Farming activities in Senjiamman Nagar (Pulicat)







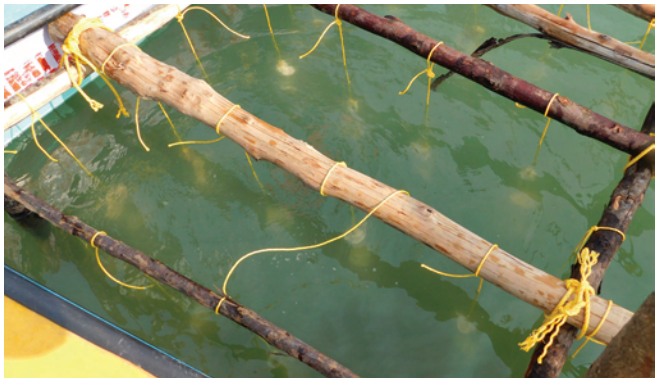

Farming activities in Senjiamman Nagar (Pulicat)








Farming activities in Senjiamman Nagar (Pulicat)








Farming activities in Kottaikadu








Farming activities in Kottaikadu

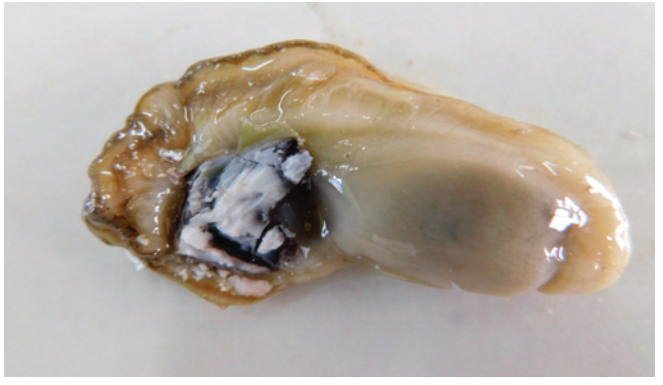








Farming activities in Kottaikadu



Farming activities in Cuddalore Chinna Kuppam








Farming activities in Cuddalore Chinna Kuppam